A1 A method and a device in connection with a reel-up

The invention relates to a method according to the preamble of the appended claim 1 in connection with a reel-up. The invention also relates to a device in connection with the reel-up, the device being of the type presented in the preamble of the appended claim 8.

A2 By means of a continuous reel-up a continuous paper web, typically of several meters wide, passed from a paper machine or finishing machine for paper, is reeled to form machine reels. To implement the reeling in a continuous manner, a reel change has to be conducted at fixed intervals, so that when the preceding machine reel becomes full, the web is guided to travel to a new reel spool forming the core of the next machine reel.

In the reeling station, when the reel to be reeled becomes full, the web is cut by means of a suitable method which depends e.g. on the grammage of the web, and the new end of the web following the cutting point is guided around a new empty reel spool which has been brought to a change position from a reel spool storage at an earlier stage. There are a number of patents and patent applications related to this change sequence or a part of the same. The Finnish patent 95683 of the applicant, the corresponding international publication WO 93/34495 and US patent 5,779,183 disclose a press device by means of which the access of air underneath the web entering the reel is prevented. The Finnish patent application 915432 of the applicant, as well as the corresponding US patent 5,360,179, in turn, disclose different ways of cutting the web in connection with the reel change. The Finnish patent 97339 of the applicant and the corresponding EP application publication 739695 and the US patent 5,765,462 disclose a blade cutting device that cuts the web. Furthermore, the Finnish patent 100590 of the applicant discloses a manner in which the web can be cut in full-width by means of a striking cutting blade, and the new end of the web can be blown on a new empty reel spool by means of an air blowing.

It is known to move the aforementioned press device in which a brush or a roll functions as a contact member, to a loading contact with a surface of the reel, substantially the lower surface of the reel, in the end phase of the reeling process, and the press device is conveyed in loading contact with the full reel when the reel is transferred to a change position. By means of press devices of prior art it has been possible to prevent the access of air in the reel, and thereby the slackening of the surface layers of the machine reels.

However, especially when the running speeds exceed 25 m/s, problems are caused by the behaviour of the "tail" remaining topmost in the machine reel after the cutting.

When a brush-like member is used as a contact member in the press device, the bristles of which are in contact with the surface of the machine reel, problems are caused by the insufficient linear load in the contact point. The contact of the brush and the paper produces dust. Furthermore, the dragging force caused by the brush causes a change in the web tension in connection with the reel change.

The press roll used as a contact member keeps the reel well in its form, and it does not produce dust. When the tail meets the press device it is not in contact with the surface of the reel, and it hits the press device thus causing a strong pull in the paper, wherein pieces of paper are torn off. The press roll presses these loose pieces on the surface of the paper reel, and these pieces travel along with the rotating motion of the reel to the upper sector of the reel, wherefrom they may drift in the nip between the new, initiated reel and the reeling cylinder, thereby ending up inside the new reel and causing broke and problems at the next stage of the process, especially in a supercalender or a corresponding multinip calender.

~~One purpose of the present invention is to introduce a method in~~ connection with the reel change, by means of ~~which~~ the above-presented drawbacks of the ~~solutions of~~ prior art can be eliminated to a large degree, ~~thus~~ improving the state of the art in the field. To attain this ~~purpose, the method according to the invention is primarily~~

characterized in what will be presented in the characterizing part of the appended claim 1. The device according to the invention, in turn, is characterized in what will be presented in the characterizing part of the appended claim 8.

The method is characterized in that the reel and/or the tail which is not in contact with the reel or tends to loosen from the same are/is controlled at two distinct points on the perimeter of the reel: control of the outer surface layers of the reel by means of a press roll producing the loading and control of the tail by means of a separate guiding member which applies a smaller load to the reel and whose surface speed differs substantially from the surface speed of the peripheral surface of the reel. The latter member is primarily used for controlling the tail by guiding it towards the reel and/or by wiping off the pieces detached from the tail before they are conveyed to the upper half of the reel wherefrom they could again end up in the closing reeling nip. The device is characterized by the combination of the press roll of the reel and the guiding member of the tail.

The other characteristics of the invention are disclosed in the appended dependent claims and in the description hereinbelow.

In the following, the invention will be described in more detail with reference to the appended drawing, in which

Fig. 1 shows a side-view of a situation in the reel-up of a paper web before the cutting of the web,

Fig. 2 shows a side-view of a situation in the reel-up of a paper web after the cutting of the web, and

Fig. 3 illustrates the device on larger scale.

Fig. 1 shows a reel-up for paper web known as such, in which reel-up the method and the device are applied. Said reel-up is a continuous reel-up which reels successive machine reels R around reel spools 2 from a continuous paper web W passed from a paper machine or

finishing machine for paper. During the reeling, the reel spools 2 are supported at the ends by means of a suitable supporting structure, such as reeling rails. During the reeling, the machine reels are rotated with a centre-drive of their own. Fig. 1 shows a situation in which, to implement the reel change, the machine reel R that has become full is taken away from the reeling cylinder 1 by means of reeling carriages which are in contact with the ends of the reel spool 2, via which reeling cylinder the paper web W has been passed to the reel through a reeling nip between the reel and the cylinder 1. The narrowing gap between the incoming run of the web and the outer surface of the reel, via which gap air tends to intrude into the reel, is marked with an arrow G. Furthermore, Fig. 1 shows how the new reel spool 2 is brought in contact with the web W travelling on the surface of the reeling cylinder 1 to conduct the change.

Fig. 1 also shows a press device 3, which in the situation of Fig. 1 is used for preventing the access of air via the gap G underneath the web in the reel. In a situation where the reel R is becoming full, but is still in contact with the reeling cylinder via the reeling nip, the press device 3 has been brought in loading contact with the surface of the reel R, and it is transferred forward together with the reel to the change position of Fig. 1, out of contact with the reeling cylinder 1a. Solutions for transferring the press device 3 in contact with the reel and forward together with the reel, are not described in more detail. Thereafter the web is cut at the point marked with arrow C for example with a full-width blade cutting device or by means of change blowing, whereafter the new end of the web is guided around a new reel spool 2.

Fig. 2 shows a situation after the cutting. The free final end of the web that constitutes the last section of the web passed to the reel forms a tail H, which tends to get loose from the reel R. After the cutting the deceleration of the speed of rotation of the reel R also begins, for example by means of the centre-drive of the reel spool forming the core of the reel. In the direction of rotation of the reel R the press device 3 comprises first a guiding member 3a, the purpose of which is primarily to guide the tail of the cut web W closer to the peripheral surface of the reel or against the peripheral surface of the reel, and a

member which is loaded against the surface of the reel with a particular force and which rotates at the same surface speed as the reel, forming a nip with the peripheral surface of the reel. Such a member can be composed of a press roll 3b journalled for free rotation. The guiding member 3a is not necessarily in contact with the surface layers of the reel, and if it is in contact with them, it lies, in any case, against the peripheral surface of the reel with a lower force than the press roll 3b following the guiding member 3a and preventing the access of air from the gap G to the reel in the situation of Fig. 1, and binding the surface layers of the reel in the situation of Fig. 2 to keep them together especially when the speed of rotation of the reel is reduced.

The guiding member 3a is located within the area of the lower half of the reel and it is used for guiding the travel of the tail H forming the final section of the cut web W. The guiding member 3a is preferably located in the vicinity of the lowest point of the reel, for example in the sector of ± 45° therefrom. The press roll 3b is located within a short distance after the guiding member 3a. The distance is such that it is not possible for the tail to substantially loosen itself from the surface of the reel. The distance, when measured along the perimeter of the reel is advantageously approximately smaller than ¼ of the diameter of the reel, in other words in degrees approximately under 30°.

The free tail H revolves during several laps around the rotation axis of the reel on the perimeter of the reel R along with the rotating motion of the reel during several revolutions, and the guiding member 3a is used for controlling the behaviour of the tail H advantageously during several revolutions after the cutting of the web.

Fig. 3 shows the press device 3 in a more detailed manner. The guiding member 3a is attached to the same frame 3c as the press roll 3b which is arranged rotatable. The frame can be transferred e.g. along guides in the machine direction. As can be seen in the drawing, the control member is a brush formed of bristles, which is in contact with the peripheral surface of the reel R, thus wiping the surface of the reel when the reel is rotating. The press roll 3b is utilized for attaining the loading necessary for binding the surface layers together. If there were

no guiding member 3a before the press roll 3b, the tail H of the paper web would make a movement resembling a whiplash onto the surface of the roll 3b, and it would be broken into pieces, which the roll then would press against the surface of the reel. Now, in the situation shown in Fig. 3, the guiding member 3a prevents the pieces of paper possibly loosening from the web from being conveyed between the roll and the reel. The pieces possibly loosening from the tail remain in the guiding member 3a and drop down therefrom, wherein they can be easily guided for example to a pulper, which is below the reel-up.

The parallel surface speed of the surface of the guiding member 3a opposite to the reel and of the peripheral surface of the reel differ substantially from each other. Thus, there is a relative speed difference between the peripheral surface of the web and the surface of the guiding member opposite to the same. The speed difference is such that the speed of the surface of the guiding member 3a in the direction of the peripheral surface of the reel is clearly lower than the surface speed of the reel. The speed difference can be attained by arranging the guiding member 3a static, i.e. stationary, as the brush shown in Fig. 3, wherein the speed of the surface of the guiding member 3a with respect to the peripheral speed of the reel in the direction of travel of the peripheral surface of the reel is $-v1$, where v1 is the surface speed of the peripheral surface of the reel. Another possibility to attain the speed difference is to arrange the guiding member 3a rotatable in such a manner that it has the same direction of rotation as the reel R, wherein the surface of the guiding member 3a that is closest to the peripheral surface of the reel moves in a direction opposite to that of the peripheral surface of the reel R. If the surface speed of the guiding member is v2, the relative surface speed of the guiding member 3a with respect to the peripheral surface of the reel R is $-(v1 + v2)$. If the surface of the guiding member 3a is arranged to move in the same direction in which the peripheral surface of the reel moves at a lower surface speed v2 than the peripheral surface of the reel in the point closest to the reel, the relative surface speed of the guiding member 3a with respect to the peripheral surface of the reel R is thus $-v1 + v2$. All the aforementioned cases cause the "dragging" of the surface of the

guiding member 3a against the peripheral surface of the reel R and/or against the tail H of the web.

The surface of the guiding member 3a opposite to the peripheral surface of the reel R is arranged elastic in such a manner that it can be pressed against the surface of the reel within a particular distance, and it can also conform to the variations in the diameter of the reel. Thus, the position of the guiding member 3a with respect to the reel R does not have to be adjusted accurately. To implement the yielding surface, the guiding member 3a may be provided with bristles, but also with other types of flexible members, which wipe the surface layers of the reel R and/or the tail H. The guiding member 3a may be provided with flexible strips or the like, extending in the transverse direction of the machine, i.e. in the direction of the reel axis, forming a sort of a doctor blade. Such flexible members, e.g. bristles, strips or the like guide the loose tail H softly on the surface of the reel, and because of the slower surface speed, release the pieces possibly loosening from the tail in the impact of its end. It is also possible that the static guiding member only has one transverse strip against the perimeter of the reel or in the vicinity of the same, within a particular width lying against the peripheral surface of the reel and/or guiding the tail H.

If the guiding member 3a is a rotating guiding member, its surface can also be formed of bristles, wherein it is a kind of a brush roll wiping the surface of the reel, or of strips transverse to the machine direction, the strips also wiping the surface of the reel, wherein it is a kind of a strip-faced roll.

The surface structure of the guiding member 3a can also be a uniform compressible structure, and it can, for example, be the surface of a sponge-like body.

Fig. 3 shows how the surface of the guiding member 3a touches the peripheral surface of the reel R. The touch is then a light touch in such a manner that the yielding surface of the member 3a has been pushed a short distance (distance d) against the peripheral surface of the reel. According to Fig. 3, the rear part of the surface of the brush is within a

particular distance in a light contact with the peripheral surface of the reel.

Another alternative is a contactless guidance, in which the surface of the guiding member 3a is not in contact with the outer surface layer of the compact reel R, but rather in contact with the tail H formed of the final end of the web, thus guiding the tail closer to the web. The distance from the outermost surface layer of the reel is in this case small, advantageously under 10 mm. The guiding member 3a within a small distance from the peripheral surface of the web is also capable of preventing the entrance of the small pieces loosened from the tail between the press roll 3b and the reel R.

The guiding member 3a is most advantageously located before the press roll 3b in the direction of rotation, wherein it first receives the loose tail H coming in the direction of the perimeter of the reel. It is, however, possible that the guiding member 3a is within a short distance from the press roll 3b after the same, wherein it is in a sufficiently tight contact with the surface of the web in such a manner that it is capable of wiping off the pieces of paper passed through the nip between the reel and the press roll 3b from the surface of the reel. The surface structure and the motion (static/rotating) of the guiding member 3a can be arranged according to the description above.

The guiding member 3a can also be a relatively rigid member which is directed against the direction of rotation of the reel and located before the press roll 3b in the direction of the perimeter of the reel, and it is spaced within a short distance (e.g. under 20 mm) from the peripheral surface of the reel, wherein the purpose of the same is to receive and cut the loose end of the tail H which is farther away from the reel than the positioning distance of the member, and to guide the tail preceding the loose end towards the nip between the press roll 3b and the reel R. Such a member can taper off against the direction of rotation of the web, and it can be formed as a sharp-edged cutting blade.

The guiding member 3a and the press roll 3b are advantageously arranged to a common frame 3c to be moved in the machine direction

with respect to the reel R and together with the motion of the reel, in either one of the above-described orders. Thus, the distance between the press roll 3b and the guiding member 3a can also be arranged to be suitably small in view of their good co-operation. As can be seen in Fig. 3, the press roll 3b can be journalled rotatably on brackets 3d protruding from the frame, and the guiding member can be mounted to an arm 3e protruding from the frame. A suitable loading and location of the guiding member 3a with respect to the peripheral surface of the reel can be attained by running the press device 3 sufficiently far underneath the reel R from the incoming direction of the web W. The loading of the press roll 3b can also be adjustable by means of actuators arranged in the press device, and the position of the guiding member 3a can also be adjusted e.g. by changing the position of the arm 3e supporting the same. This adjustment can also be made manually before the press device is run in contact with the reel R, or the position of the guiding member 3a can be adjustable by means of suitable actuators when the press device 3 is in its operating position in connection with the reel.

The guiding member 3a advantageously extends over the entire width of the web. The control member can also extend only over a part of the width of the web for example at points where the tail H is at its longest. Thus, it can be only within an area of particular width on both edges in cases where sections which are especially long remain in the reel on said edges in gooseneck changes or corresponding change methods, in which the web is first torn from the middle. The press roll 3b advantageously extends over the entire width of the reel R.